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Tips

Filament Standoff Posts

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The design and positioning of filament standoff posts are important considerations in vacuum metallizing. The design of the posts can affect the life of the filaments, how well they perform, and how easy or difficult it is to replace the filaments. Standoff positioning is critical for maximizing part coverage, extending filament life, and minimizing rejects due to burns or evaporant drips.

How may standoff posts should a chamber have? Twenty-two is a common number for a 48" chamber, eleven above the buss bar and eleven below. A 72" chamber can accomodate more. The amount of power that you have available and the amount of evaporant to be deposited will determine the number of filaments that you require. If the weight of your evaporant is at or above 15% of the filament weight, and your coverage is inadequate, you should be adding filament standoff posts to improve coverage. A filament can't really evaporate more than 15% of its weight per cycle without severely shortening its life and without the possibility of molten evaporant dripping off the filament.

It is possible to have too many standoffs. If this occurs, the standoffs will shadow one another and block parts from receiving proper coverage. The evaporant ends up on a neighboring standoff post instead of on your parts. To some extent, this is unavoidable, but the closer your standoffs are to one another, the worse it is. You can simulate this effect using a bare light bulb. If you hold your hand up near the wall, it casts a shadow about the size of your hand. As you move closer to the bulb, the size of the shadow grows. In a similar manner, a filament post will block evaporant from reaching the parts and since it is so close to the filament, the shadow it casts is large.

The filament angle or pitch is also important. The filament legs should be horizontal, while the centerline of the coil should be at a 20° to 30° angle off vertical (Figure 1). Filament should be fixtured so that the bottom turn, and not the bottom leg, is the lowest point. This orientation will allow the evaporant to properly wet the filament without encouraging balling and dripping of evaporant at the bottom of the filament. Proper wet out and reduced balling will improve part coverage and extend filament life.

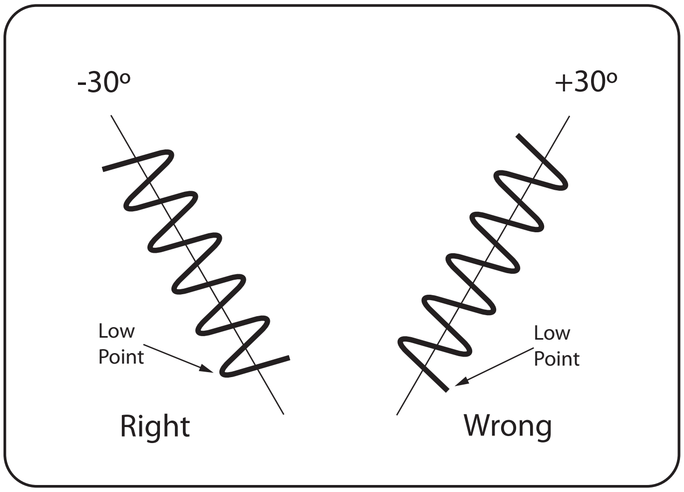

Figure 1

Standoffs should always be positioned to accept filaments without having to bend or distort them. Bending or twisting filaments can drastically reduce filament life.

If your filament posts cannot be properly adjusted, they may need to be replaced. Replacemnt posts can be as expensive as $100 per set, depending on the style. Is the cost justified? Consider this example: You are a shop running two shifts per day. Each of your chambers has 22 filaments and can run three loads per hour. You are currently getting 7 shots per filament and your filaments cost $.80 each. Some of your filaments have to be bent to fit in their holders and some are at an odd angle. Let's see how your costs change if you upgrade your posts and get one more shot per filament with the new standoff posts.

3 shots per hour x 16 hours per day x 250 days per year = 12,000 shots per year

12,000 shots x (22 filaments per chamber/7shots per filament) x $.80 per filament = $30,166

12,000 shots x (22 filaments per chamber/8 shots per filament) x $.80 per filament = $26,400

$30,166 - $26,400 = $3,766 per year (by getting just one extra shot)

22 holder sets replaced at $100 each costs $2,200, leaving you $1,566 ahead in year one. Each subsequent year, the full $3766 savings will be realized. So you can see that significant savings are possible from changing filament standoff posts. Do the math with your own numbers.

There are several styles of filament posts available. The simplest is nothing more than brass threaded rod with a hole drilled through it. The filament is placed in the hole and a wing nut or knurled nut tightens the filament down. Many improvements on this style exist. The hole can be replaced with a slot for easier loading. The nut can be replaced with a spring loaded washer to prevent over-tightening. The spring should be stainless steel for easy cleaning and may have a cover on it to prevent buildup of evaporant from hindering performance. The brass can be replaced with copper for better conductivity. Sometimes a cavity is drilled down in the post and the spring is located internally.

The posts can be fastened to the buss bars by one of several methods. Holes can be drilled and tapped in the buss bars and the standoff posts threaded into them. The posts are now fixed in position. This is good only if you never need to change the angle or location of the bars. If the holes are blind holes, they may trap gas, which can be a problem. Another method of fastening is to have the post silver soldered into a block that is split and has a hole that matches the diameter of the buss bar. The two halves of the block are placed around the buss bar and bolted together. This method also offers good electrical contact and has more flexibility in the positioning of the bars. It is more expensive than the first method due to the extra material and machining. A cheaper variation of this method is to use a U-bolt to go around the buss bar and have it pass through two holes in the standoff post and fasten with two nuts. Electrical contact is not as good as with the other two methods.

If you would like more information about the design and manufacture of filament standoff posts, please contact us.

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